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HIGH POWER FACTOR CONVERTER
[Horikiritsu konbata]

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Claim

A type of high power factor converter characterized by the fact that it has the following parts: a carrier generator, which rectifies an AC voltage to generate a carrier at a frequency higher than that of said AC voltage as the converter input voltage, an error amplifier that amplifies the difference between the converter output voltage and a reference voltage, a comparator, which compares the output voltage of said error amplifier with the voltage of said carrier to output a pulse sequence, a low-pass filter that removes the carrier frequency component from said pulse sequence, which takes a voltage proportional to said converter input voltage as the amplitude, and a controller, which compares the output of said low-pass filter and the current flowing in the converter and controls a switching element ON/OFF.

Detailed explanation of the invention [0001] Industrial application field

The present invention pertains to a type of high power factor converter for use in the input circuit of switching power source, inverter, or the like. Especially, it pertains to a type of high power factor converter that does not require an expensive multiplier.

[0002] Prior

art

The high power factor converter is a type of converter that has the input current converted to sinusoidal form to reduce the harmonic components so as to improve the power factor. Control ICs dedicated to high power factor converters are commercially available in Micro Linear Corp. of U.S.A.
and Siemens AG of Germany. Such ICs are described in detail in the following reference: "Denshi Gijutsu" published by Nikkan Kogyo Shinbun K.K., Vol. 32, No. 3, pp. 77-84 and pp. 90-99.

[0003]

Figure 3 is a diagram illustrating the constitution of the circuit of the high power factor converter using said IC. In the following, an explanation will be given regarding the operation of the circuit. Current Ii flows in switching element (3), and, when the current value reaches current reference Ir, pulse width controller (10) generates a signal that turns OFF the switching element. This current reference is formed as the product of input voltage Vi and the output of error amplifier (8) for voltage control by multiplier (9). Its waveform is the rectified sinusoidal wave similar to input voltage Vi, and its amplitude is the value obtained by stabilizing the output voltage. Due to said operation, the switching element is controlled ON/OFF such that the AC input current becomes a sinusoidal wave and the output voltage is stabilized.

[0004]

Problems to be solved by the invention

However, in the aforementioned prior art, because dedicated controlling IC contains a multiplier, it becomes expensive. Also, because it contains a pulse width controller, the degree of freedom in circuit design also becomes lower. This is undesired.

[0005]

The purpose of the present invention is to solve the aforementioned problems of the prior art by providing a type of high power factor converter characterized by the fact that the controller is formed without using a multiplier, and it can use various types of commercially available switching power source control ICs as the pulse width controller, so that it can provide the high power factor converter with low price and high degree of freedom of design.

[0006]

Means for solving the problems

The present invention provides a type of high power factor converter characterized by the fact that it has the following parts: a carrier generator, which rectifies an AC voltage to generate a carrier at a frequency higher than that of said AC voltage as the converter input voltage, an error amplifier that amplifies the difference between the converter output voltage and a reference voltage, a comparator, which compares the output voltage of said error amplifier with the voltage of said carrier to output a pulse sequence, a low-pass filter that removes the carrier frequency component from said pulse sequence, which takes a voltage proportional to said converter input voltage as the amplitude, and a controller, which compares the output of

said low-pass filter and the current flowing in the converter and controls a switching element ON/OFF.

[0007]

Operation

For the high power factor converter of the present invention, as a method in forming current reference Ir for comparing with the current flowing in the converter, instead of a multiplier, the output of the error amplifier for controlling the converter output voltage is subjected to pulse width modulation by means of a sawtooth form carrier wave, and the carrier frequency component is removed by a low-pass filter from the pulse sequence that has a voltage proportional to the converter input voltage as its amplitude. As a result, the same result as that of a multiplier can be obtained. This circuit is made of converter, op-amp and other general purpose parts, so that it is inexpensive. Also, one may make use of various commercially available types of switching power source controlling IC in the pulse width controller that controls the switching element ON/OFF, and the degree of freedom of design of circuit is high.

[0008]

Application Examples

Figure 1 is a diagram illustrating an application example of the present invention. Figure 2 is a diagram illustrating the waveforms of the various portions of Figure 1. In the following, an explanation will be given regarding an application example of the present invention. Output Vs of error amplifier (8) for output voltage control is compared with sawtooth form carrier Vc by means of comparator (11), and it is subjected to pulse width modulation (Figure 2(a)). The voltage obtained by dividing converter input voltage Vi is taken as the amplitude of the pulse sequence subjected to pulse width modulation (Figure 2(b)). The carrier

frequency component of pulse sequence Vm is removed by low-pass filter (12) to form current reference Ir (Figure 2(c)). This current reference Ir and the fall in voltage on detecting resistor (4) that detects converter input current Ii are input to pulse width controller (10) to control ON/OFF switching element (3) of the converter. Here, for example, pulse width controller (10) is made of TL494 of Texas Instruments, Ltd. of U.S.A. As a result, the input current waveform of the converter becomes similar to the current reference, and the AC input current form becomes a sinusoidal wave.

[0009]

Effects of the invention

According to the present invention, it is possible to construct the high power factor converter from general purpose parts without using an expensive multiplier. Consequently, it can be manufactured at a low cost. Also, as the pulse width controller, one may make use of the commercially available switching power source controlling IC. As a result, the degree of freedom in circuit design becomes higher.

Brief explanation of figures Figure 1 is a diagram illustrating the constitution of the circuit of the high power factor converter in an application example of the present invention. Figure 2 is a diagram illustrating the waveforms of operation of the various portions of Figure 1. Figure 3 is a diagram illustrating the circuit constitution of the high power factor converter in the prior art.

Brief explanation of keys

1 Rectifier

2 Choke coil

3 Switching element

4 Current detecting resistor

5 Diode

6 Capacitor

7 Load

8 Error amplifier

9 Multiplier

10 Pulse width controller

11 Comparator

12 Low-pass filter

13 Voltage dividing resistor

14 Voltage dividing resistor

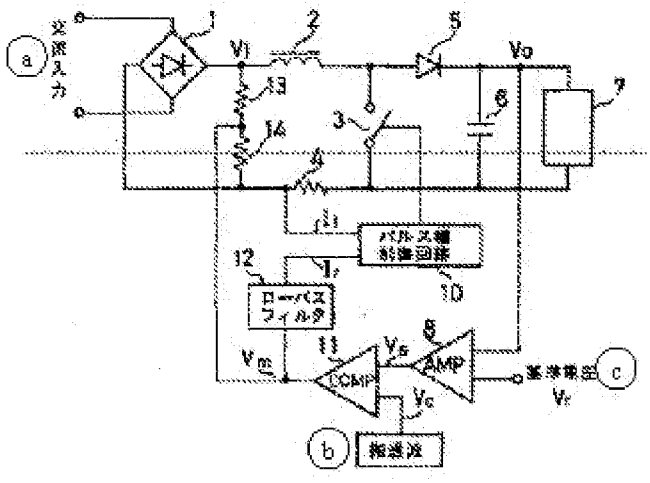

Figure 1

Key:
a AC input

b Carrier

c Reference voltage

10 Pulse width controller

12 Low-pass filter

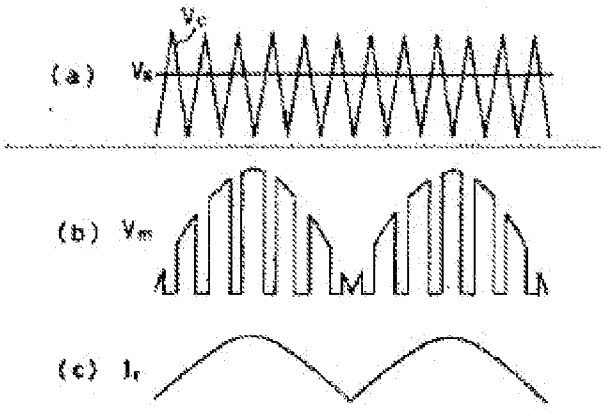

Figure 2

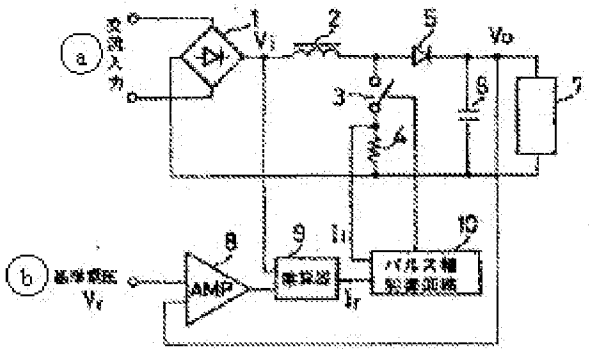

Figure 3

Key: a AC input

b Reference voltage

9 Multiplier

10 Pulse width controller